

Example 1

Differentiate and simplify $p(\theta) = \sin^4 3\theta$

Example 2

Find $\frac{dq}{du}$ for $q = \frac{\tan^2 3u}{1 + \sec 3u}$.

Example 3

Find the equation of the tangent line to the curve $y = x \tan x$ at the point on the graph where $x = \frac{\pi}{4}$. Give your answer in exact form, that is, without using decimal approximations. Recall that $\tan\left(\frac{\pi}{4}\right) = 1$ and $\cos\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$.

Example 4

Let $y = e^t \cos t$.

(a) Find $\frac{dy}{dt}$.

(b) Find $\frac{d^2y}{dt^2}$.

(c) Show that y satisfies the **second order differential equation** $\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + 2y = 0$.

Example 5

Find the derivative of each function.

(a) $f(x) = x \arctan(e^x)$

(b) $g(y) = \arcsin(\sqrt{y})$

(c) $w = \arctan(2 \sin v)$

Example 6

Find $\frac{dy}{dx}$ if

(a) $\frac{x}{x+y} = y^2$

(b) $y = \tan \sqrt{x^2 + y^2}$

(c) $xe^{xy} = y$

Example 7

Consider the curve with equation $y^3 - 3xy^2 = 9 - 3x^2y$.

(a) Find an equation of the tangent line to the curve at the point $P(1,3)$.

(b) Find the point(s) on the curve where the tangent line is horizontal.